INFRASTRUCTURE SOUTH AUSTRALIA

DECEMBER 2021

CONFIDENTIAL

MOUNT BARKER MASS TRANSIT STUDY

Options Assessment Final Report

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EXECUTIVE SUMMARY

PROJECT OBJECTIVE

WSP was engaged by Infrastructure South Australia (ISA) to complete a strategic (high-level) and technical assessment of mass transit options between Mount Barker and metropolitan Adelaide. The study is intended to provide a holistic, independent review and strategic direction for options to address passenger transport for a region experiencing high population growth. As part of this process, WSP:

- Examined population growth and demographics in Mount Barker and the Adelaide Hills, what these mean for travel demand between Mount Barker and the city and the potential demand for increased public transport patronage.
- Conducted a thorough (though not exhaustive) review of the physical and operational characteristics of the existing road and rail corridors and the challenges these present in providing an improved public transport system.
- Conducted a review of the existing passenger bus service operating in the Adelaide Hills and Mount Barker regions and between Mount Barker and the city, including patronage and reliability of service.
- Conducted demand modelling to compare travel demand forecasts and network performance statistics for both road and rail public transport improvement options (against the base case).
- Reviewed previous studies, reports and investigations that proposed transport options in and around metropolitan Adelaide, Mount Barker, and the Adelaide Hills.
- Assessed a long list of possible improvement options and reduced these to a shorter list using a multicriteria assessment (MCA) approach.
- Provided a high-level assessment of a shortlist of options, including high level cost estimate and rapid cost benefit analysis (CBA).

ABOUT MOUNT BARKER

Mount Barker in the Adelaide Hills region is one of the fastest growing local government areas (LGA) in South Australia. Its population is forecast to reach close to 47,000 by 2036, with the wider Adelaide Hills region growing to 80,000 people over this period. This growth has been supported by recent investments in transport infrastructure such as expanding the road network in Mount Barker, an additional interchange connection to the South East Freeway at Bald Hills Road and park n ride facilities to improve access to passenger bus services.

This population growth is leading to increased demands for employment, education and other services which cannot be supported by the region alone. Therefore, there will be an increasing demand for travel to the Adelaide metropolitan area and the CBD via the South Eastern Freeway (SEF) and Glen Osmond Road. Nearly 50,000 vehicles per day use the freeway west of Crafers and over 40,000 at the Mount Barker end. Over ten per cent of this traffic is heavy vehicles.

Concerns are being raised by councils and the Adelaide Hills community over congestion and safety along these roads, especially in peak commuter periods. Councils have expressed that investment in public transport serving the Hills region would help to reduce the dependency on private vehicle travel and therefore positively impact congestion. Mass transit passenger services between Adelaide and Mount Barker are provided only by buses and presently just six per cent of commuter trips made to and from Mount Barker LGA use these services. This is far less than the metropolitan Adelaide average of 8.8 per cent of work trips.

WHAT IS THE ISSUE?

The existing road corridor linking Adelaide and Mount Barker comprises the South Eastern Freeway and Glen Osmond Road. The route caters for both freight and commuter traffic and is prone to congestion in peak periods. The daily peak hour commute along the SEF-Glen Osmond Road route is challenging; Glen Osmond Road and the Tollgate intersection (Glen Osmond Road-Cross Road-Portrush Road intersection), in particular, operate at capacity in peak periods. Bus services between Mount Barker and the city that use these roads are caught up in the congestion and experience long delays and queues at Tollgate and other signalised intersections along Glen Osmond Road. Also, for the steep descent section of the freeway, buses are required to travel at a maximum speed of 60km/h and in the outer lane with slow moving heavy vehicles.

The existing bus service is purported to be unreliable because of the variable travel times along the SEF and Glen Osmond Road. The peak period bus schedule for Mount Barker (like all other suburban bus services) makes allowances for variable travel times in peak periods (up to 10 minutes). There are concerns that the impact of congestion on travel times will be exacerbated as traffic volumes on these roads increase as population grows in Mount Barker. Whilst this may be true, the Hills peak bus services currently performs as good as if not better than other bus services in Adelaide in terms of on-time running (Section 5.2.3).

Also, the population density in the Mount Barker region is relatively low compared with suburban Adelaide and residents travel to widely dispersed destinations in Adelaide and suburbs for employment, education, and other services. Public transport does not service all these trips efficiently or effectively.

ROAD AND RAIL CORRIDORS

Travel between the Adelaide plains and the Mount Lofty Ranges is facilitated by road and rail.

The primary road corridor comprises the South Eastern Freeway (and Glen Osmond Road to the city). The SEF is characterised by its steep and continuous decent from Crafers to Tollgate. The SEF in this segment is constrained by the Heysen Tunnels and long sections of steep rock cuts adjacent to the road. Glen Osmond Road is a four-lane undivided road and is constrained by abutting properties on both sides.

Concerns for safety along the downhill section of the freeway have led to the introduction of speed restrictions and mandated left-lane use for heavy vehicles. Further, frequent partial and occasional full closure of the freeway due to incidents results in significant delays for private vehicles, commercial vehicles, and public transport.

The rail corridor between Mount Barker and Adelaide is part of the Adelaide-Melbourne standard gauge freight route and interstate passenger line. Commuter passenger services operate on a single broad-gauge track between Adelaide Railway Station (ARS) and Belair, with no passenger services provided to the Adelaide Hills region. ARS is a terminus and is currently operating at close to capacity. The track alignment follows a circuitous path through the difficult terrain of the Adelaide Hills with steep, continuous grades, frequent curves and several tunnels and bridges, limiting train speeds in both directions. The freight corridor through the Hills comprises a single standard gauge track, with passing loops allowing bidirectional travel. The freight line is owned and operated by ARTC. There are also several at-grade level crossings on the corridor, including on key arterial roads.

PUBLIC PASSENGER SERVICES

The Adelaide Hills is serviced by several passenger bus routes which link dispersed townships in the region with the larger commercial centres in Stirling, Blackwood, and Mount Barker, provide access to Adelaide and Mitcham on the Adelaide Plains and provide a loop service in and around Mount Barker. Travel times for buses between Mount Barker and the city are influenced by the speed restriction on buses using the freeway, delays at intersections along Glen Osmond Road (including Tollgate intersection), and mid-block congestion along the route. These are highly variable and impact on bus scheduling.

Peak period bus services operate at about 60 per cent occupancy. Park n ride facilities in Dumas Street and Dutton Road in Mount Barker are well used and to some extent compensate for the low population density in Mount Barker and the corresponding small walking catchment for the conventional bus stops.

The population (now and forecast future) was compared with a set of benchmark population densities required to support various public transport modes (conventional bus, bus rapid transit and light and heavy rail). These indicate that a regular bus service is appropriate for the current and forecast population of Mount Barker.

REVIEW OF PREVIOUS WORK

There have been several recent studies and proposals presenting options to improve public transport to Mount Barker or improve efficiency of traffic flow along Glen Osmond Road and the SEF. These studies have generally been undertaken at a high level and at best provide a basis for more detailed investigations.

Specifically, DIT has completed several studies on various elements of the corridor which vary in scope and focus. DIT's studies are reasonably high level and have tended to focus on one component of the corridor. These studies do not review the relevant issues and constraints in the corridor or wider network issues or impacts in any detail. Within the Adelaide Hills BRT Planning Study, DIT has been comprehensive in the range of options assessed, but the constraints and complexities of each option are only superficially examined. The BRT cost estimates are high level and strategic in nature, and broadly align with WT Partnership's estimates provided in this report. Some of the rail option cost estimates appear more conservative, but differing alignments could account for this.

Overall, the literature generally confirms that improved bus services is the preferred option in the short term. A rail service on the existing line would not realise competitive travel times with current bus services. While this claim is disputed by some, this report's assessment of travel times confirms that services would be uncompetitive. In the longer term, the literature is divided, with some proponents suggesting a new rail corridor as the preferred solution, emphasising regional development opportunities. On the other hand, DIT recognises the high cost of a new rail corridor, and the relatively small, and dispersed, catchment size. More detailed studies have focussed specifically on improving freight transport through the Adelaide Hills and have concluded that both a road and rail freight bypass are unviable.

The gaps identified through the review of previous work include:

- Analysis of network level problems and opportunities for public transport.
- Consideration of broader economic development and placemaking.
- Like for like comparison of transport options across all modes.
- Interrogation of the interrelation of freight and passenger transport movements through the Adelaide Hills (including rail freight).
- Detailed passenger demand modelling and forecasting.
- In depth understanding of the constraints of the existing rail corridor.

OPTIONEERING

Previous investigations have provided a broad range of potential options to improve public transport in the region. An extensive list of options was considered, sourced primarily from recent studies, strategies, unsolicited private proposals, and consultation undertaken as part of this engagement. These range from relatively inexpensive improvements that might support (and make more attractive) the existing bus service, operational improvements including priority for public transport along the existing corridor and significant infrastructure upgrades including road widening and new alignments for bus or rail services. Overall, 48 options or sub-options (covering either part of or the full length of the corridor) were assessed via a multicriteria analysis (MCA). The assessment criteria placed a heavy bias towards those options which would provide a significant improvement in travel time (compared to private vehicle transit via SEF-Glen Osmond Road route), and those that would provide travel time reliability. A lower emphasis was placed on cost. The options shortlist is shown in Table 0-1 below with alignments presented in Figure 0-1 and Figure 0-2.

It should be noted rail options will likely require some continuation of the bus services, as the rail catchment alone would isolate many users of the existing bus services in the Adelaide Hills.

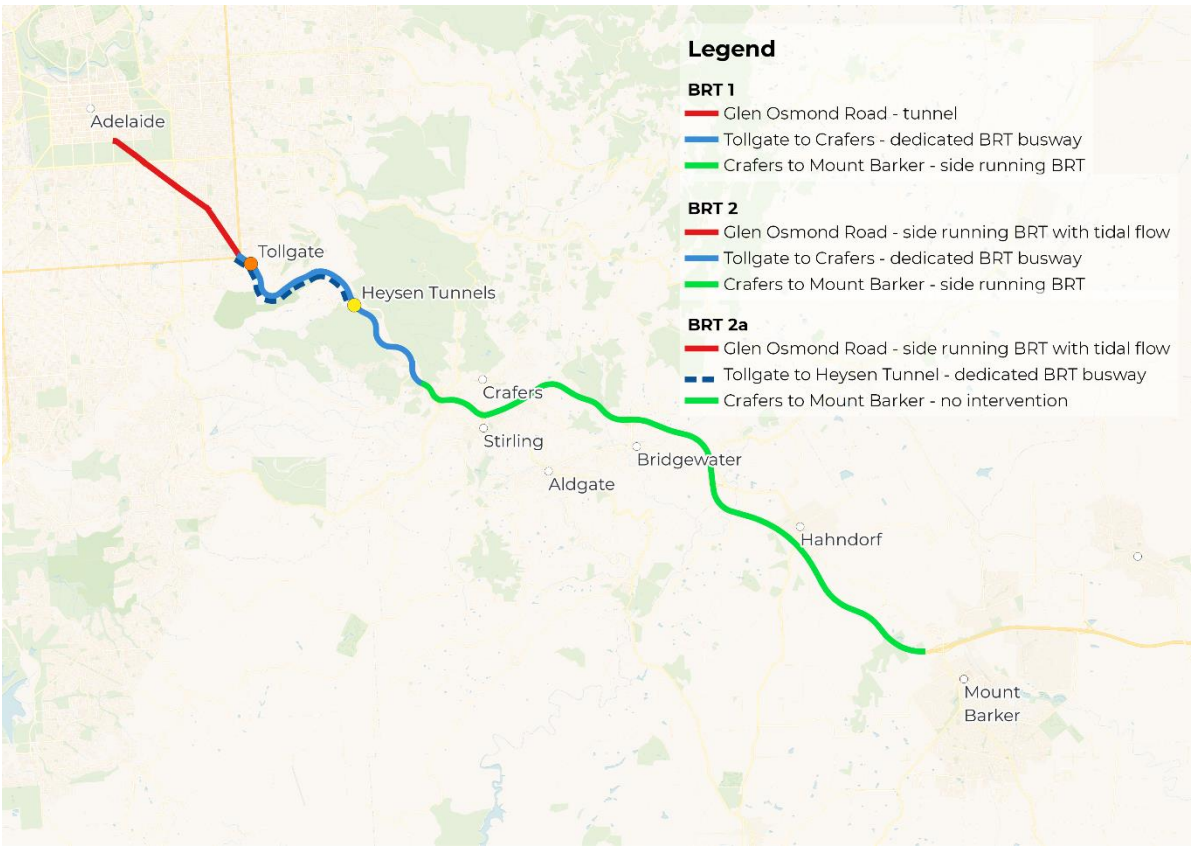
Table 0-1 Options shortlist

OPTION	BRIEF DESCRIPTION
Option BRT 1: BRT tunnel and busway Glen Osmond Road - tunnel BRT busway, Crafers to Tollgate - dedicated BRT busway, Mount Barker to Crafers - convert shoulder to side running BRT	This option includes a 4km tunnel under Glen Osmond Road for a dedicated BRT busway. From Crafers to Tollgate, a dedicated BRT busway will be constructed. This could be along a new alignment or on the existing corridor (noting that for this assessment we assume the existing corridor). This will include an additional tunnel adjacent to the Heysen Tunnels to service the dedicated BRT route. From Crafers to Mount Barker, the existing shoulder will be converted to a side running BRT
Option BRT 2: Full side-running BRT Glen Osmond Road - side running BRT, Crafers to Tollgate - dedicated BRT busway, Mount Barker to Crafers - convert shoulder to side running BRT	This option includes a within carriage way side running BRT (i.e., a bus lane) on Glen Osmond Road with tidal flow implementation to limit the impact on peak direction traffic. From Crafers to Tollgate, a dedicated BRT busway will be constructed. This could be along a new alignment or on the existing corridor (noting that for this assessment we assume the existing corridor). This will include an additional tunnel adjacent to the Heysen Tunnels to service the desiccated BRT route. From Crafers to Mount Barker, the existing shoulder will be converted to a side running BRT.
Option BRT 2a: Part side-running BRT Glen Osmond Road - side running BRT, Tollgate to Heysen Tunnels - dedicated BRT busway, No intervention from Mount Barker to Heysen Tunnels	This option includes a within carriage way side running BRT (i.e., a bus lane) on Glen Osmond Road with tidal flow implementation to limit the impact on peak direction traffic. Between Tollgate and the Western end of the Heysen Tunnels, a dedicated BRT busway will be constructed. No intervention is provided between the Heysen Tunnels and Mount Barker.
Option 8: New light rail corridor Light rail adjacent South Eastern Freeway via Greenhill Road	A new light rail track to be constructed along the South Eastern Freeway from Mount Barker to Crafers. From Crafers it will follow a new alignment towards Greenhill Road. It will then follow the Greenhill Road corridor to the CBD. A tunnel of five kilometres would be required.
Option 10: New heavy rail corridor Heavy Rail adjacent to South Eastern Freeway via Bridgewater tunnel New alignment between Mount Barker and Stirling	A heavy rail track would follow the existing South Eastern Freeway corridor to Bridgewater. From Bridgewater to Torrens Park, there would be a 15km tunnel. The rail line would join the existing line around Mitcham station.

OPTION	BRIEF DESCRIPTION
Option 1b: Least cost rail Utilise the ARTC line to Belair and then transfers onto Belair line	This includes any necessary improvements to the ARTC line to make it suitable for passenger trains. Passengers would be required to transfer at Belair onto the existing service. A station and out-turn for the standard gauge track would be required at Belair to facilitate the transfer. This option terminates at Mount Barker Junction.

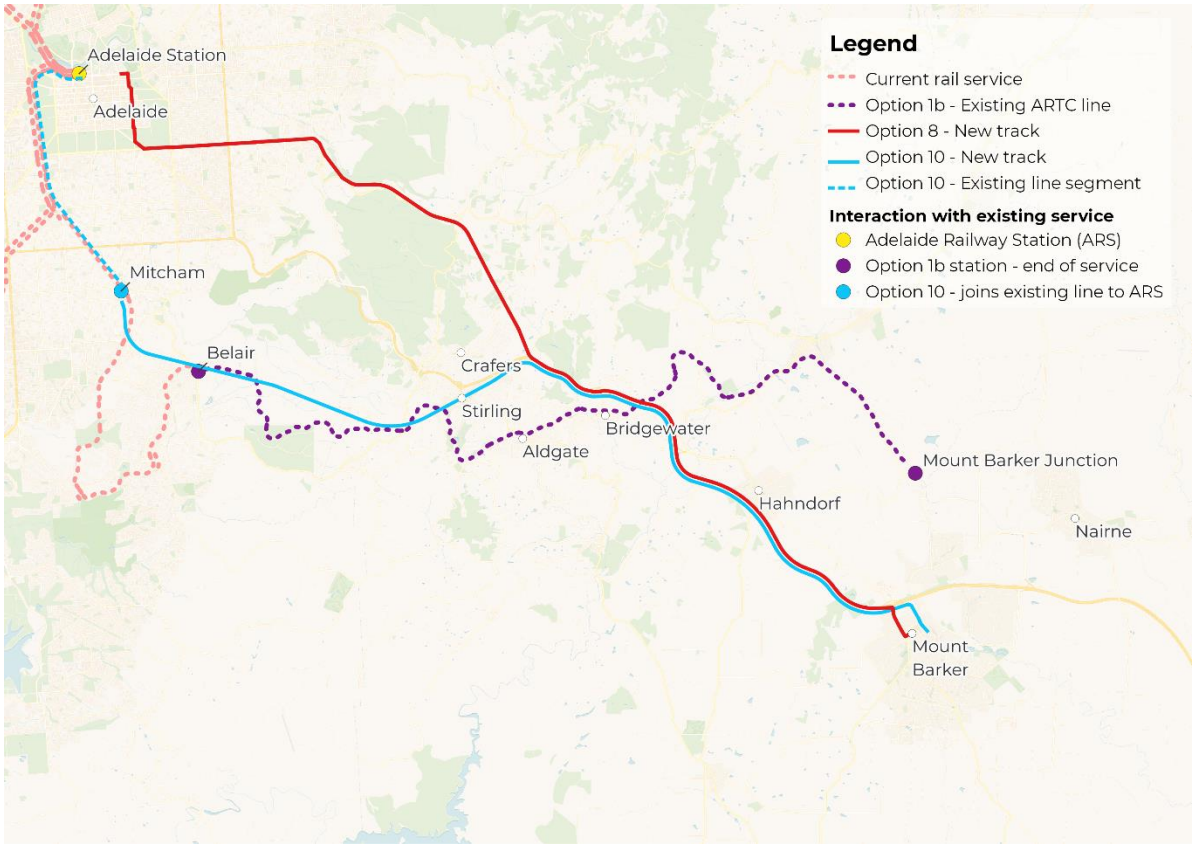
The shortlisted road options are shown in Figure 0-1.

Figure 0-1 BRT option alignments



The shortlisted rail options are shown in Figure 0-2.

Figure 0-2 Rail option alignments



Assumed travel times for the base case and each option between Mount Barker and Adelaide CBD are presented in Table 0-2. The base case travel time for both car and bus is longer than that for all three BRT options, as well as Option 10 (New heavy rail corridor). Option 1b (Least cost rail) is significantly longer than the base case bus travel time.

Table 0-2 In vehicle travel time and speed assumptions by option (Mount Barker Station or equivalent to Adelaide CBD)

OPTION	TRAVEL TIME (MINS)
Base case	Car: 40 minutes Bus: 53 minutes (up to 63 minutes)
BRT 1	33 mins
BRT 2	36 mins
BRT 2a	39 mins
Option 8	55 mins
Option 10	37 mins
Option 1b	71 mins (excluding time waiting on passing loops)

Note: Travel times for BRTs were estimated based on average speeds along each section of the route. Travel time for rail/light rail options were based on average speeds, as well as accounting for acceleration, deceleration and stopping time at stations.

ECONOMIC VIABILITY

Costs for the shortlisted options are presented Table 0-3. Infrastructure capex and opex costs were estimated to Class 5 accuracy, meaning they are based on a project definition of zero to two per cent design. It is assumed that all infrastructure capex and opex costs would be incremental to the base case, which is therefore set to zero.

Rollingstock opex and capex were based on the proposed service plan for each option. It is assumed that the existing bus services would continue to operate if a rail option was implemented, so rail rollingstock costs would be supplementary to base case costs. In contrast, for the BRT options, the proposed service plan would replace the existing services. The BRT options have a fleet cost saving compared to the base case because of consolidating feeder services as well as faster travel times.

Table 0-3 Cost estimates for shortlisted options

OPTION	INFRASTRUCTURE CAPEX	ANNUAL INFRASTRUCTURE OPEX	ROLLINGSTOCK/ FLEET CAPEX	ANNUAL FLEET/ ROLLINSTOCK OPEX
Base case	$0	$0	$88 million	$53 million
BRT 1: BRT tunnel and busway	$4,000 million	$18 million	$71 million	$46 million
BRT 2: Full side-running BRT	$1,800 million	$10 million	$74 million	$47 million
BRT 2a: Part side-running BRT	$300 million	$2 million	$76 million	$48 million
Option 8: New light rail corridor	$3,600 million	$117 million	$93 million	$94 million
Option 10: New heavy rail corridor	$5,800 million	$19 million	$65 million	$126 million
Option 1b: Least cost rail	$250 million	$2.5 million	$37 million	$67 million

These short-listed options were assessed via a rapid CBA. The CBA considered changes in four key benefit streams:

- Vehicle operating costs
- Travel time: at a network level, and both in-vehicle time and out of vehicle time
- Crash costs / road safety savings
- Environmental externality costs

The rapid CBA results reveal that none of the six options assessed are economically viable (all have a benefit-cost ratio below one). CBA results are presented in Table 0-4.

The best performing option is BRT 2a, which has a BCR of 0.23 and a Net Present Value (NPV) of -$144 million. This is due to the comparatively low cost of this option.

Table 0-4 Rapid CBA Results (discounted at 7%)

Measure	**Option 10**	**Option 1b**	**Option 8**	**BRT 1**	**BRT 2**	**BRT 2a**
BCR	0.02	0.01	0.01	0.04	0.05	0.23
NPV	-$3,813m	-$711m	-$3,056m	-$2,884m	-$1,323m	-$144m

The BRT options provide higher cost savings in travel time than the rail options because they impact existing bus passengers as well as resulting in some mode shift from cars. In contrast, the rail options have lower benefit because they do not attract as many users – many existing bus users would continue to use the bus rather than the train because they do not fall within a reasonable catchment area. Across all options, the demand and resulting travel time savings are not sufficient to outweigh project costs.

None of the options were shown to attract significantly higher patronage and consequent reduction in car travel on the SEF and Glen Osmond Road is minimal. Forecasts indicated a maximum reduction of just 120 vehicles in the peak hour on the SEF.

In addition, those options that do provide a travel time advantage over the existing bus service or travel by car have the benefits substantially reduced because of the low density of the Adelaide Hills catchment and diverse trip destinations which are not well served by public transport. Across the options, there are noticeable disbenefits from out of vehicle travel time (waiting for a service, transfers or accessing a station or bus stop) as well as time lost through the high take up rate of park n rides. Most users who shift from car would use the park n rides, so would incur travel time to and from these locations (i.e., require private vehicle transit to access the service).

The network level impacts are also minimal. With the low mode shift from cars, there is no discernible impact on users of the road network. BRT 2 and 2a see an overall decrease in road trips which could be attributed to a reduction in discretionary travel because of negative traffic impacts.

Sensitivity tests were conducted on key variables including discount rate, evaluation period, costs and benefits and BRT average speeds. None of the options achieved a BCR above one in any of the tests. This assessment clearly shows the substantial difference between estimated benefits and the significant cost of potential options, which would be difficult to overcome without a substantial step change in the demand. Several factors would need to change to contribute to increased patronage demands – high population and population density along the public transport corridor and higher concentration of trip ends.

CONCLUSIONS

The following summary comments and conclusions are drawn from the investigations and analyses presented in this report.

The population in the Mount Barker area is growing rapidly. Without any improvements to public transport there will continue to be a heavy reliance on cars. It is clear from the investigations undertaken and discussion with stakeholders that without any improvement in public transport services, the forecast growth in population in Mount Barker will exacerbate the current high dependency on car travel to the city, particularly during peak periods (Section 2).

The existing bus service between Mount Barker and Adelaide is said to be unreliable because of the variable travel times along the SEF and Glen Osmond Road. There are concerns that this will be exacerbated as traffic volumes on these roads increase as population grows in Mount Barker. Whilst this may be true, the Hills peak bus services perform as good as if not better than other bus services in Adelaide (Section 5.2.3). The peak period bus schedule for Mount Barker, like all other bus services, makes allowances for variable travel time in peak periods.

Comparisons of on-time running of public transport services in Adelaide (generally) also shows that buses are less reliable than trams and trains which emphasises the benefits of a dedicated corridor over sharing the road space with other vehicles. Notably, the Belair line passenger train service performs poorly compared to other train line services which is probably an indication of the problems of running on a bi-directional track with passing loops.

Presently, on the Mount Barker bus services, the average passenger boarding per peak period service on weekdays is only about 40 representing only 60 per cent capacity of a bus (Section 5.3). Whilst the patronage may be reflective of perceptions of an unreliable service (and therefore travel by car instead), it is also possibly a function of the dispersed trip ends at both the origin and destination i.e., the low population density in

Mount Barker and the dispersed locations in Adelaide and its suburbs for employment and other services (Section 2.3).

Comparisons of the present and forecast future population density for Mount Barker with population density benchmarks to support various modes of public transport (regular bus, bus rapid transit, light rail, and heavy rail) indicates that the existing regular bus service to Mount Barker is appropriate for its current population. The forecast future population will be insufficient to support a Bus Rapid Transit (BRT) and would be most appropriately served by an increase in the regular bus services. (Section 5.6).

The conclusion of the benchmarking exercise is supported by high level forecasts of patronage using a strategic transport model (Section 5.5). Modelling of the performance of public transport operating in its own dedicated corridor (by both bus and rail) and hence providing a quicker and more reliable service showed that there would be:

- Only marginal increase in the proportion of all trips travelling by public transport.
- Only marginal switch from car to bus or rail.
- More people travelling by bus than rail as the passenger catchment is smaller for rail than for the bus route and many people continue to opt for the bus service.

Studies and proposals for improved public transport services for Mount Barker undertaken by DIT, RDA, community groups and interested parties' range widely in their depth of investigations, estimates of future patronage (if any) and estimates of costs. Many of these studies ignore or downplay the significant challenges to be overcome, not only in the immediate corridor but also in the wider transport network. Additionally, the dispersed nature of trip origination and destination is often overlooked. This is particularly the case for proponents of rail solutions. Challenges often overlooked include the capacity of the Adelaide Railway Station terminus, the single track on the Belair line, and the impacts on other road traffic that would be imposed by reassigning traffic lanes or increased closures of railway level crossings.

The short list of six options (3 BRT, 2 heavy rail and one light rail) was developed to address the travel time variability and service reliability issues and provide a journey travel time that might compete with the private car. The capital costs of these options range from between $250m and $300m for the low-cost rail and road option and $4 and $5.8b for the higher cost options (Section 10).

The CBA of these options indicated quite clearly that none of the options could be justified, with all having BCR's well below 0.3. The best performing option from an economic viewpoint was the low-cost BRT option (Section 11) because it had relatively lower costs than the other BRT options.

Comparing the BRT and rail options:

- The BRT provides a more direct (shorter) route between Mount Barker and the city.
- Buses can negotiate steeper grades at higher speeds than rail (albeit limited to 60km/h on the downhill section of the freeway).
- The journey time is quicker and hence more competitive with travel by private car.
- BRT services a larger passenger catchment. Regular buses would still be required to service the catchment not served by rail. BRT provides more flexibility to run services to meet the needs of the community, particularly in low density areas.
- The cost of the BRT option is significantly lower than the best performing heavy rail option (Option 10) although the cost of land acquisition is not included.
- The rail operating largely in its existing corridor through the urban area requires no land acquisition and no demolition of properties. The BRT tunnel option will minimise the land required along Glen Osmond Road but will still impact on properties at each end of the tunnel portals.

There is no "easy" solution. Any option that would make a meaningful difference to the public transport travel times and reliability will be complex, incurring significant costs and result in possible adverse impacts

on communities along the route. Challenges arise from the feasibility and logistics of traversing the topography of the Mount Lofty Ranges, addressing congestion and operational issues in the wider transport system and the significant costs of doing so. Community and interest groups would appear to prefer rail as a long-term option, with constraints and capacity on the existing road corridor flagged as a key impediment to improved bus services.

NEXT STEPS

It is apparent that there is a significant gap in knowledge and understanding of issues associated with both bus and rail transport within the Hills community. This high-level assessment of the many options put forward has identified these and described the challenges that would need to be overcome and the limitations they pose on any new service. Sharing this information with the community may assist in helping to understand why many of the proposals put forward are not appropriate. The knowledge sharing should address:

- Defining the problem and its extent with the existing service.
- Appreciate the characteristics and volume of current and future travel demands and trip ends and how public transport should best respond to these.
- Explain the constraints in the road and rail corridors and why these influence the development of improvement options.
- Present some of the options and the challenges they would need to address.

There would appear to be no immediate imperative to implement substantial improvements to the existing public transport system.

However, notwithstanding these conclusions, it may be prudent to undertake more immediate planning investigations to reduce the frequency and extent of incidents that result in partial or full closure of the freeway (and associated significant delays to all road users including buses). Work is already underway to determine the feasibility of switching traffic between carriageways and running contraflow during such incidents and this might be extended to include considerations for bus priority which might be extended to options to provide bus pre-emption at the Tollgate intersection.

There may also be opportunities to revisit these short-listed options as part of DIT's ongoing investigations into other improvements to the wider transport system including for example improvements to traffic flow more generally along Glen Osmond Road.

If a mass transport initiative is pursued for the corridor, it is recommended then that the following be undertaken:

- Detailed traffic modelling to consider broader network implications of BRT options, including consideration of freight movements (both road and rail).
- Further investigations of bus lanes and tidal flow on Glen Osmond Road, with detailed consideration of impacts on surrounding residents and businesses.
- Further investigations to prove the concept of a BRT corridor on the SEF west of Crafers.
- Government to engage with the community and stakeholders to present the findings of this study and further engagement to ensure affected parties have opportunities to raise issues and concerns and remain informed of project progress.